A Crossbreeding Study of the Cedar Tree Borer, *Semanotus ligneus amplus*, and the Fir Tree Borer, *S. litigiosus*

(Coleoptera: Cerambycidae)

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During a study of the biology of the fir tree borer, *Semanotus litigiosus* (Casey), a laboratory technique for inducing mating and oviposition was devised (Wickman, 1968). Also during this work, one male cedar tree borer, *S. ligneus amplus* (Casey), was captured in flight on 9 May 1965. This presented an opportunity to check on Craighead's (1921) report that these two species do not crossmate.

The male cedar tree borer was placed with one unmated female fir tree borer. They mated immediately and did so repeatedly for 4 days. On 10 May, the fir tree borer laid 20 eggs; on 11 May, 25 eggs; and on 12 May, 2 eggs. On 21 May, egg hatch began, and all eggs successfully hatched by 24 May. The larvae were immediately placed on an artificial media (Lyon and Flake, 1966). Most of the larvae died within 2 weeks, but six individuals did molt once and survived for a month.

The success of the first crossmating prompted further studies to determine the ease of crossbreeding and the possibility of progeny completing their development to viable adults.

TECHNIQUES

A plentiful supply of fir tree borers was available for the study from windthrown white fir, *Abies concolor* (Gordon & Glendenning) Lindley, near Hat Creek, California. Cedar tree borers were harder to find, but one windthrown incense-cedar, *Libocedrus decurrens* Torrey, in the area provided adults for the study.

On 4 March 1966, unmated adults of both species were dissected from their overwintering pupal chambers in the wood. They were collected in individual gelatin capsules, brought to the laboratory, located at Berkeley, California, and held at 2° C. for 10 days until the test was started.

A male and female were placed on a moist blotter paper on the bottom of a petri dish (in four dishes one male was given two females), and overhead fluorescent lights and room temperature of 20° to 23° C. provided satisfactory conditions for mating and ovipositing.

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On 15 March 1966, 12 breeding tests were started in petri dishes (Table 1) with reciprocal pairings and checks.

Eggs were also used from crosses and checks for cytological studies. Newly deposited eggs were smashed, then stained and fixed with aceto-orcein. Slides were studied at ca. 900 ×.

Results

Mating took place immediately and continuously during the first day in all dishes. Oviposition started 2 days later in the dishes with female fir tree borers and continued for 11 days, with peak egg production occurring around the 4th and 5th days. Cedar tree borer females started oviposition 5 days after mating and continued for 9 days, with peak production occurring the 3rd to 5th days. However, two female cedar tree borers (one check and one cross) produced no eggs.

Larvae began hatching 8 days after oviposition and continued for 7 additional days. Egg hatch varied from 54 to 100% and was considered acceptable under the artificial conditions of rearing.

Larvae were transferred to artificial media in new dishes the day they hatched. They all started feeding immediately, usually under the media next to the dish. Their growth appeared to be satisfctory on the media diet, and early mortality was similar to that experienced in previous rearings of natural progeny on the artificial media (Wickman, 1968). The first 14 days after hatching, mortality was about 10%—31 of 306 (Table 1).

Then, on 14–16 April 1966, a heat wave with unseasonably high temperatures occurred in Berkeley. The temperatures in the rearing room rose to about 33° C. and remained that way over the weekend. By Monday morning, 18 April, all larvae were dead except one second instar in dish 12; it died on 2 May.

The cytological studies showed similar chromosomal formulae and configurations for the two species, but the work did not produce clear-cut results. We could not provide enough eggs from the breeding and rearing portion of the study to determine the chromosome numbers with certainty.

Discussion

The crossbreeding test must be considered partially successful, since viable eggs were produced and mortality in the first larval instar was twice as high in the checks as it was in the crossbred insects. However, it is unfortunate that uncontrolled high temperatures apparently killed all but one of the test insects.

TABLE 1. Matings of the cedar tree borer (CTB) and fir tree borer (FTB) in petri dishes, Berkeley, California, March–April 1966

Dish and Mating	Eggs laid[1]	Oviposition Start	Oviposition Finish	Eggs hatched	Eclosion Start	Eclosion Finish	Larval mortality[2]	
	Number	*Dates*		*Percent*	*Dates*		*Number*	*Percent*
1 CTB FTB	39	3/20	3/24	57	3/31	4/2	2	10
2 CTB FTB	0	—	—	—	—	—	—	—
3 FTB CTB	80	3/17	3/22	74	3/27	4/4	2	4
4 FTB CTB	50	3/17	3/23	57	3/27	3/31	2	10
5 CTB CTB	0	—	—	—	—	—	—	—
6 CTB CTB	38	3/21	3/28	90	4/2	4/7	11	32
7 FTB FTB	13	3/24	3/24	100	3/31	3/31	2	15
8 FTB FTB	29	3/17	3/25	79	3/27	4/14	0	0
9 CTB FTB	59	3/21	3/27	100	3/30	4/14	3	6
CTB 10 FTB	63	3/17	3/27	100	3/24	4/2	1	2
FTB 11 CTB	23	3/20	3/29	91	3/27	4/5	2	10
CTB 12 FTB	14	3/22	3/27	50	4/2	4/7	6	100
FTB								

[1] Includes eggs used for cytological work.
[2] Mortality of first instar prior to heat wave.

The tests have shown that the two species will readily crossmate, produce eggs, and the eggs will hatch. In nature, both species fly and attack in the same timber stand at the same time of year and accidental crosses seem possible. If so, do progeny result? So far there has been no success in rearing crossbred larvae to adults. Perhaps they cannot develop to adults; and this, combined with their host specificity for mating and oviposition sites, keeps the two species distinct.

Craighead's failure to mate the two species during his tests of Hopkins' host selection principle remains unexplained. They mated readily under the conditions described. This mating may lead to further interesting work on host selection and speciation if viable progency can be produced.

Cytological studies would be valuable for ascertaining the genetic integrity of the two species and their potential for hybridizing.

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A New Species of *Syntropis* from Baja California Sur, Mexico with Notes on its Biology

(Scorpionida: Vejovidae)

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In 1900 Kraepelin described a new genus and species of scorpion which he named *Syntropis macrura* based on a single specimen. This genus was of special interest because it was characterized by the presence of a single, unpaired inferior median keel on the metasoma, instead of the paired condition generally found in the family. Over the years this genus acquired more and more interest since its uniqueness within the family Vejovidae became better recognized and since it still remained known by only the type specimen.

During the summer of 1968 extensive field work in the Baja California peninsula of Mexico revealed much information about the genus *Syntropis*. Two parties, one led by Mont A. Cazier, the other by myself, together collected several dozen *Syntropis macrura* and over 1,000 specimens of a new species of *Syntropis*, here described and named *Syntropis longiunguis*.

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